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APPARATUS FOR MEASURING CHILD SEAT ANCHOR TENSION

Technical Field

The present invention relates to a child seat anchor system for a motor vehicle seat, and more particularly to apparatus for measuring the tension exerted on the anchor system.

Background of the Invention

Vehicle occupant weight sensing systems are useful in connection with air bags and other pyrotechnically deployed restraints as a means of characterizing the occupant for purposes of determining whether to allow or suppress deployment of the restraints. In cases where an infant seat or child booster seat is place on the seat cushion and cinched down with the seat belt, the presence of the infant or child seat can be detected based in part on a measure of the seat belt tension. However, in cases where the vehicle seat is equipped with a child seat anchoring system such as the LATCH (Lower Anchors and Tethers for CHildren) system, the infant or child seat can be secured using the seat anchors instead of the seat belt. Since tension applied to such child seat anchors produces an effect similar to that which occurs when the child seat is secured with the seat belt, it is desired to measure the tension exerted on such a child seat anchoring system.

Summary of the Invention

The present invention is directed to apparatus for measuring the tension exerted on a child seat anchoring system including a pair of anchor brackets disposed between the bottom and back cushions of a vehicle seat. In a first embodiment, the anchor brackets are directly coupled to individual tension sensors mounted on an anchor frame that is bolted to the seat frame supporting the bottom cushion of the seat. In a second embodiment, the anchor brackets are fastened to an anchor frame that is pivotably mounted on the seat frame, and

the anchor frame is additionally coupled to the seat frame through a single strain sensor responsive to the tension exerted on the anchor frame by the anchor brackets.

Brief Description of the Drawings

The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a diagram of a vehicle seat including an occupant weight estimation apparatus and a child seat anchor tension measurement apparatus according to a first embodiment of this invention.

Figure 2 is a rear view of the anchor tension measurement apparatus of Figure 1.

Figure 3 is a partial diagram of a vehicle seat equipped with a child seat anchor tension measurement apparatus according to a second embodiment of this invention.

Figure 4 is rear view of the anchor tension measurement apparatus of Figure 3.

Description of the Preferred Embodiment

Referring to Figures 1-2, the present invention is disclosed in the context of a vehicle passenger seat 10 equipped with a fluid-filled seat cushion bladder 12 for estimating the weight of a seat occupant based on the fluid pressure in the bladder 12. An exit port of the bladder 12 is coupled to a pressure sensor 14 by a tube 16, and the pressure sensor output is supplied to a passenger occupant detection system electronic control unit (PODS ECU) 18, which determines if deployment of supplemental restraints for the occupant of seat 10 should be enabled or disabled. In general, however, the present invention also applies to other types of occupant weight sensing systems, such as systems that sense the strain in seat frame 20, or systems that include a network of pressure sensitive cells distributed over the seating area of bottom cushion 22.

The seat 10 is equipped with a pair of child seat anchor brackets 24a, 24b for securely fastening an infant or child booster seat 26 to the seat 10 via the tethers 26a (only one of which is depicted in Figure 1). The anchor brackets 24a, 24b are located near the left and right rear corners of the cushion 22, and the outboard end of each bracket 24a, 24b is disposed in a gap between the cushions 22 and 28 as shown.

In general, the present invention is directed to an apparatus including at least one tension or strain sensor coupled to an anchor frame for measuring the tension exerted on the anchor brackets 24a, 24b. Figures 1-2 depict a first embodiment where the anchor brackets 24a, 24b are directly coupled to individual tension sensors 30a, 30b mounted on an anchor frame 32 that is bolted to the seat frame 20. Figures 3-4 depict a second embodiment of this invention where the anchor brackets 24a, 24b are fastened to an anchor frame 50 that is pivotably mounted on the seat frame 20, and a single strain sensor 52 coupled between the seat frame 20 and the anchor frame 50 measures the force applied to the anchor frame 50 by the anchor brackets 24a, 24b. The strain sensors 30a, 30b, 52 may be constructed as disclosed, for example, in the U.S. Patent No. 6,605,877, issued on August 12, 2003 and incorporated herein by reference.

Referring to the embodiment of Figures 1-2, the anchor frame 32 is contoured to form right and left pocket areas 34a, 34b at the leading edges thereof, and the tension sensors 30a, 30b are bolted into the respective pocket areas. The anchor frame 32, in turn, is bolted to the seat frame 20 via the apertures 36a, 36b. If desired, the anchor frame 32 can be configured so that the sensors 30a, 30b are essentially aligned with the child seat tethers 26a, in which case the anchor brackets 24a, 24b will be straight instead of angled. The anchor frame 32 may be stamped sheet metal, for example, and surface contours 38 may be included to provide increased stiffness. The tension sensors 30a, 30b develop electrical signals corresponding to the tension exerted on the anchor brackets 24a, 24b, respectively, and such signals are provided to PODS ECU 18 via lines 40a, 40b. In cases where the child seat tethers 26a are formed with a

single strip of material passing through the seat 26, one of the anchor brackets 24a, 24b can be welded directly to the anchor frame 32 as shown in Figures 3-4, and the single tension sensor 30a or 30b will provide an adequate measure of the combined tension applied to the anchor brackets 24a, 24b. The PODS ECU 18 utilizes the anchor tension signals to detect the presence of an infant or child seat 26, and also to compensate the occupant seat weight indication (the pressure signal output of pressure sensor 14, for example) or a threshold to which the occupant seat weight indication is compared.

Referring to the embodiment of Figures 3-4, anchor frame 50 is contoured to form right and left pocket areas 50a, 50b at the leading edges thereof, and the anchor brackets 24a, 24b are welded into the respective pocket areas. As with the anchor frame 32, the anchor frame 50 may be stamped sheet metal, for example, and include surface contours 56 to provide increased stiffness. The lower sides of anchor frame 50 are flanged as indicated by the reference numerals 58, each flange 58 having a mounting aperture 60 as shown in Figure 3. A rod 62 (or two individual posts) securely fastened to the seat frame 20 passes through the apertures 60 to pivotally support the anchor frame 50 with respect to the seat frame 20. The anchor frame 50 is additionally coupled to the seat frame 20 by the tension sensor 52 so that tension applied to the anchor brackets 24a, 24b produces a corresponding force that is measured by the sensor 52. Referring to Figure 3, a mounting tab 66 formed at one end of sensor 52 is fastened to seat frame 20, and a rod 68 formed at the other end of sensor 52 is secured to the anchor frame 50. In the illustrated embodiment, the rod 68 terminates in a cross-piece 68a that is captured by a pair of oppositely depending tabs 70a, 70b formed in anchor frame 50. Tension applied to the anchor brackets 24a, 24b tends to rotate the anchor frame 50 toward the infant seat 26 about the rod 62, and the resulting force measured by sensor 52 provides a measure of the total tension. As with the embodiment of Figures 1-2, the output of tension sensor 52 is provided to PODS ECU 18, which utilizes the anchor tension signals to detect the presence of an infant or child seat 26, and to

compensate the occupant seat weight indication or a threshold to which the occupant seat weight indication is compared.

In summary, the present invention provides a reliable and cost-effective apparatus for measuring the tension exerted on a pair of child seat anchor brackets in a vehicle seat. While the invention has been described in reference to the illustrated embodiments, it should be understood that various modifications in addition to those mentioned above will occur to persons skilled in the art. For example, the strain sensors 30a, 30b, 52 may be replaced with suitably mounted strain gauges, and so on. Accordingly, it will be understood that anchor tension measurement devices incorporating these and other modifications may fall within the scope of this invention, which is defined by the appended claims.